REMARKS

Upon entry of this Amendment, which amends claims 1 and 13 and cancels claims 4, 5, 9-11, 16 and 17, claims 1-3, 6-8 and 12-15 remain pending.

In the December 20, 2001 Office Action, claims 1-9, 12-15 and 17 were rejected, under 35 U.S.C. 102(e), as being anticipated by U.S. Patent No. 6,037,628 to Huang (hereinafter "Huang") and claims 10 and 16 were rejected, under 35 U.S.C. 103(a), as being unpatentable over Huang.[1] Applicant respectfully requests reconsideration of the claims, in view of the above amendments and the comments below.

Rejection of Claims, 35 U.S.C. 102(e) – Claims 1-9, 12-15 and 17

In the December 20 Office Action, claims 1-9, 12-15 and 17 were rejected, under 35 U.S.C. 102(e), as being anticipated by Huang.

Huang discloses a trench MOSFET having a metal-filled trench 34, which has a bottom in contact with a heavily doped (i.e. P+) impurity region 35. As explained at line 55 of column 2, through line 3 of column 3, use of the metal-filled trench 34 allows a reduction in cell pitch (see, FIG. 11), compared to prior art structures (e.g. FIG. 10).

The methods claimed in the present invention also allow a reduction in cell pitch. However, they also recite features not taught by Huang. For example, amended independent claim 1 includes a step of:

> forming a second trench adjacent to said source region, the second trench defined by sidewalls extending into the body region and *a bottom, which terminates* below the source region and *in contact with the body region*

(emphasis supplied).

[1] In the Office Action, it is initially stated that claims 1-17 are anticipated by Huang. Later in the Office Action, claims 10 and 16 are rejected as being obvious over Huang. The reason provided for the obviousness rejection was that "Huang...discloses all claimed subject matter, but omits the second trench is approximately as deep as the first trench". As best understood, then, it appears that the Examiner meant to say that claims 1-9, 12-15 and 17 were anticipated by Huang and that claims 10 and 16 were obvious over Huang. This Amendment has been prepared, consistent with this understanding.

Similarly, amended independent claim 13 includes a step of:

> etching a second trench through the source region and into the body region, the second trench defined by sidewalls and *a bottom, which terminates in contact with the body region*

(emphasis supplied).

Hence, unlike Huang, claims 1 and 13 each recite that the bottom of the second trench (i.e. the body trench) terminates in contact with the body region. By contrast and as explained above, the bottom of trench 34 in Huang terminates in contact with a heavily doped (i.e. P+) impurity region 35.

The above distinction between Huang and the claimed invention is important because it demonstrates that the inventors in Huang were focused on establishing a low resistance contact by making sure the bottom of trench 34 was always made to be in contact with heavily doped impurity region 35. By contrast, the inventors of the methods claimed in the pending claims were not focused on establishing a low resistance contact. Rather, as highlighted in lines 23-25, on page 2 of the application, they were focused on "trench MOSFET structures and methods of manufacture" that would "improve ruggedness without compromising cell pitch or R_{DSON}." Consequently, the inventors of the presently claimed invention conceived methods to produce such structures (e.g., a device such as that illustrated in FIG. 2B). These methods are claimed in independent claims 1 and 13 and in their respective dependent claims. No such methods are disclosed in Huang. Accordingly, Applicant believes that Huang cannot be properly maintained as a § 102 reference and, therefore, requests that the rejections of claims 1-9, 12-15 and 17 be withdrawn.

Rejection of Claims, 35 U.S.C. 103(a) – Claims 10 and 16

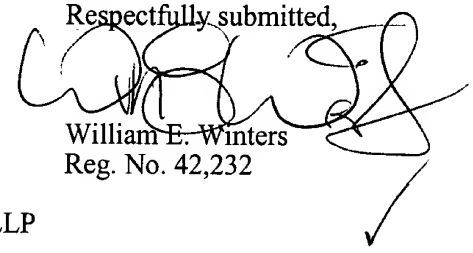
In the Office Action, claims 10 and 16 were rejected, under 35 U.S.C. 103(a), as being unpatentable over Huang. Claims 10 and 16 have been amended in this response. Accordingly, the rejections of these claims are now moot.

CONCLUSION

In view of the foregoing, Applicant believes all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 415-576-0200.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

Claim 1 has been amended as follows:

2. (Once Amended) A method of manufacturing a trench field effect transistor on a substrate having a first conductivity type, the method comprising the steps of:

forming a first trench extending into the substrate;

lining the first trench with dielectric material;

substantially filling the first trench with conductive material to form a gate electrode of the field effect transistor;

forming a body region having a second conductivity type in the substrate;

forming a source region having the first conductivity type inside the body region and adjacent to the first trench;

forming a second trench adjacent to said source region, the second trench defined by sidewalls ~~and~~ extending into the body region and a bottom, which terminates below the source region and in contact with the body region; and

filling the second trench with high conductivity material for making contact to the body region.

Claim 13 has been amended as follows:

13. (Once Amended) A process for manufacturing a trench field effect transistor comprising the steps of:

etching a first trench in a substrate having a first conductivity type;

lining the first trench with a layer of dielectric material;

substantially filling the trench with polysilicon;

implanting impurities of a second conductivity type into the substrate to form a body region having the second conductivity type over the substrate;

implanting impurities of the first conductivity type inside the body region to form a source region adjacent to the first trench;

etching a second trench through the source region and into the body region, the second trench defined by sidewalls and a bottom, which terminates in contact with the body region; and

filling the second trench with metal making contact with both the source region and the body region.